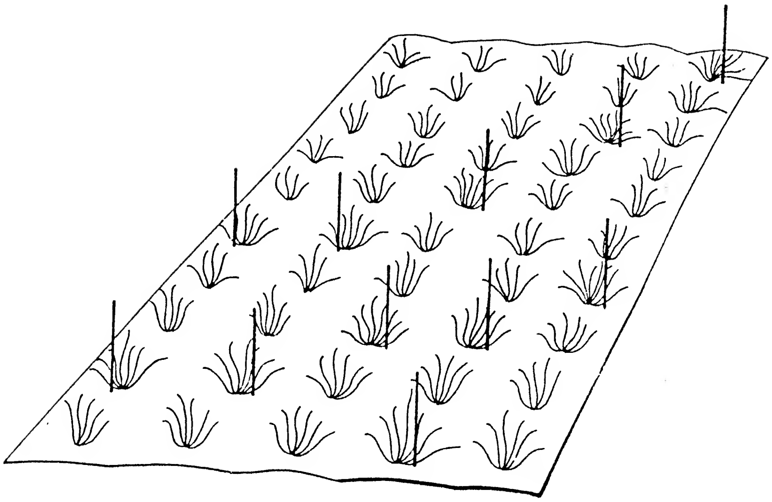


Mark the best and most vigorous plants in the field with stakes. (From Bryan,J.E., 1981, On-farm seed improvement by potato seed plot technique. Technical Information Bulletin 7, International Potato Center, Lima, Peru.

(d) Harvest the staked plants and remove the tubers from the field before harvesting the rest of the crop. This will avoid tubers from other plants getting mixed with those from the selected plants. During harvest eliminate plants with poor yields, tuber-borne diseases or deformities.

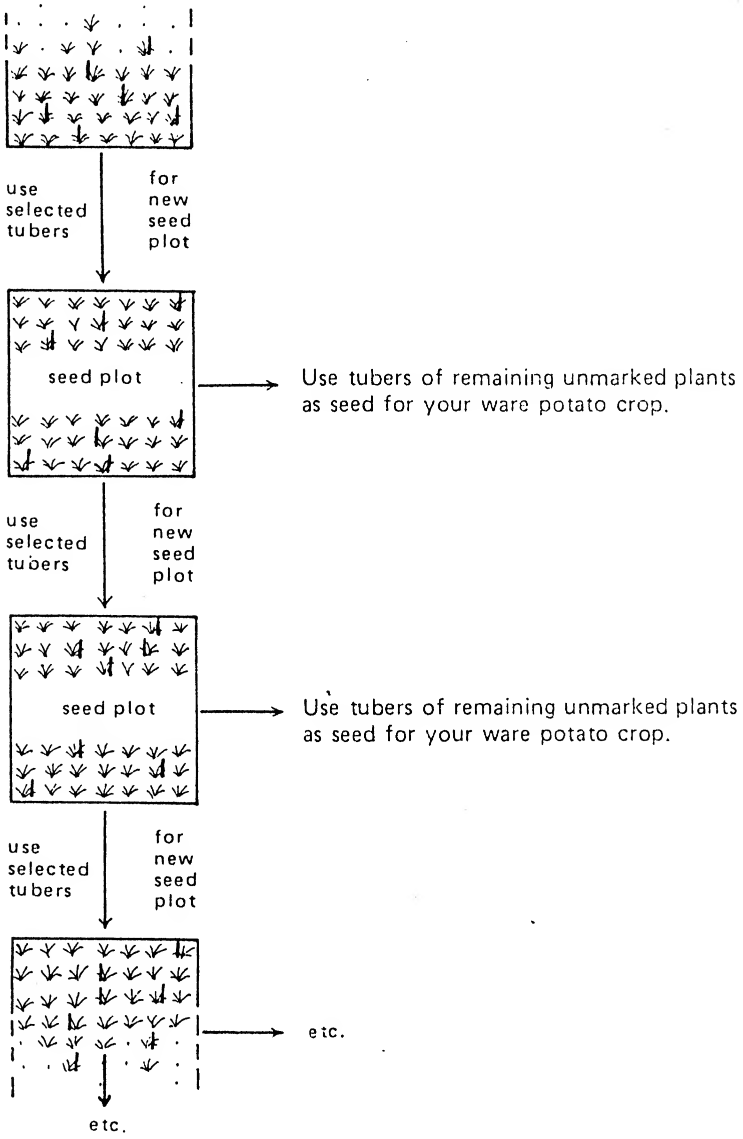
(e) Store tubers harvested from staked plants separately from other potatoes to avoid mixture and contamination.

(f) Plant the selected tubers the following year in a newly established seed plot, preferably on land not used for potatoes the previous season and, if possible, some distance from other potato crops.

(g) Again, as in (b), the best plants in the seed plot are staked.

(h) The selected plants are harvested and stored as in (d) and (e). These tubers are needed to plant the seed plot the following season. Tubers from the remaining unmarked plants are multiplied to provide seed tubers for the farmer's own commercial potato crop during the next year.

(i) The farmer should continue this process to ensure a marked and continuing improvement in the quality of his seed tuber material, in the health standard of his commercial potato crop, and in yields.


use selected tubers
for new seed plot
seed plot
Use tubers of remaining unmarked plants as seed for your ware potato crop.
use selected tubers
for new seed plot
seed plot
Use tubers of remaining unmarked plants as seed for your ware potato crop.
use selected tubers
for new seed plot
etc.
etc.

Seed plot technique repeated each season.
(From Bryan, J.E., 1981, On-farm seed improvement by potato seed plot technique. Technical Information Bulletin 7, International Potato Center, Lima, Peru.)

2.2.5 Calculation of the number of plants to stake to provide seed for 1 jerib.

A spacing of 65 cm x 25 cm = 61,538 plants/hectare
= 12,308 plants/jerib.

If the farmer gets 20 t/ha (4 t/jerib), average yield per plant is 325 g. A healthy-looking and vigorous plant should give at least 450 g.

If 20% is lost during selection and storage, each plant provides 360 g or 12 seed pieces of 30 g each.

110 staked plants will provide 110 x 12 = 1,320 seed pieces for planting the seed plot in the following year.

110 plants will be staked for the next seed plot leaving 1,320 - 110 = 1,210 plants.

The tubers from these plants will provide 1,210 x 12 = 14,520 seed pieces, sufficient to plant a little more than one jerib.

If the farmer plants seed pieces larger than 30 g, he will have to stake more plants. For example, if seed piece weight is about 40 g, stake about 150 plants. Similarly, if his yields are lower he will have to increase the number of staked plants (e.g., twice the number if the yield is only 10t/ha). In practice, make the seed plot slightly larger than calculated to compensate for plants eliminated at harvest or greater losses during storage. After one or two seasons, a farmer will know how many plants he has to stake so as to provide planting material for his commercial crop.

2.3 Selecting new varieties

2.3.1 In many countries that had their own "local" varieties (usually old European varieties), introduced modern European varieties have outperformed and replaced them. Local varieties that farmers keep for decades become degenerate and yield levels fall. This is the situation that still exists in Afghanistan, and also in Hunza in Pakistan. During the past two years in Hunza, the Dutch variety Diamant has yielded 40-60 t/ha, double that of the local variety(ies), and farmers are beginning to grow it. A similar situation could happen in Afghanistan. A strategy for improving farmers' seed stocks could be through the introduction of a new variety that yields better than Garma and Sarda, keeps well under local storage conditions, and is acceptable to consumers.

2.3.2 White-skinned varieties that are grown extensively by farmers in Pakistan include Diamant, Patrones, Ajax, and Multa. In the first instance it is recommended to try Diamant, which has a short dormancy and a harder skin than the other varieties and therefore stores better in pits. Multa is more difficult to store in pits, Patrones stores very poorly, and Ajax is very susceptible to late blight.

2.3.3 DAI extensionists should select five farmers in each of the following provinces: Wardak, Logar, Ghazni, and Paktika. Each farmer will receive 100 kg of Diamant, sufficient to plant about 1/4 jerib or 500 m^2, to compare with his local variety, and fertilizer to apply to Diamant and an equivalent area of his local variety (see 2.3.4). He will be required to store the tubers in the normal way after harvest (DAI may have to purchase the tubers if the farmer usually grows his crop for cash), and agree to make seed available to neighboring farmers. None of the tubers must be sold as ware (table) potatoes. Extensionists will be responsible for the collection of information on yields, crop performance, farmers' views, and consumer acceptability in the local community. If the variety is accepted, the farmer should plant the material the following year and DAI should purchase (if they have not already done so) and distribute seed to neighboring farmers so that the variety spreads quickly amongst growers.

2.3.4 Fertilizer should be applied to the plots at the rate of 150 kg N, 150 kg P_2O_5, and 80 kg K_2O per hectare.

This will require:
320 kg DAP + 200 kg urea + 150 kg pot. sulphate per ha

Therefore each plot of 500 m^2 will require:
16 kg DAP + 10 kg urea + 7.5 kg muriate of potash

The farmer will receive double this quantity for the two plots.

At planting apply the DAP, the muriate of potash, and 2.5 kg urea to each plot. At final earthing up apply the remaining 7.5 kg urea.

2.3.5 Jaffer Brothers (Private) Limited have a seed crop currently growing in Hunza and expect to harvest 150 t of Diamant in September/October. Demand is high. Fifty tonnes of this material will be planted as a seed crop in the Punjab in November and harvested about February next year. Arrangements should be made with JBL to purchase the 2 t of Diamant from the February harvest. The cost might be in the region of $600 per tonne. The contact is:

Mr Tariq Haq
National Sales Manager
Jaffer Brothers (Private) Ltd
2 Begum Road
Lahore

Telephone 042-213047

Mr Haq's assistant is Mr Maqbool, Area Sales Manager.

2.3.6 Arrangements should be made with:

Mr Faizullah Khan
Assistant Virologist
Vegetable Seed and Seed Potato Farm
Sariab
Quetta

to keep the potatoes in the desert-cooled potato store at Sariab. At the end of March they can be taken to Afghanistan for distribution to the selected farmers.

2.4 Extension training program

2.4.1 ADT extension workers will need to be trained in potato production so that they can instruct and help farmers to improve seed stocks, how to improve yields, harvest, handle and store tubers, and carry out on-farm demonstrations and trials. A winter training session scheduled for two weeks in February 1992 will equip the staff for the main growing season between the end of March and the beginning of May.

2.4.2 The training course should include the following topics:

Seed tuber physiology	physiological ageing dormancy apical dominance multiple sprouting senility
Seed tuber quality	seed tuber health seed tuber/seed piece size tuber cutting
Planting potatoes	seedbed preparation planting depth planting distance emergence
Cultural practices	earthing up (ridging) weed control fertilizer application water management disease and pest control
Water management	importance of water irrigation frequency of irrigation
Diseases	virus diseases late blight early blight other diseases control measures
Pests	aphids cutworms nematodes control measures
Harvesting	crop maturity foliage destruction digging tuber damage
Handling	grading curing transporting

Storage	aims of storage storage physiology methods of storage physiological losses pathological losses
Marketing	discuss marketing situation
Potato seed production	importance factors for seed tuber production seed plot technique - principle - requirements - procedure - seed plot size
On-farm demonstrations/trials of new varieties	principle plot design evaluation procedures

2.4.3 The spring crop in the NWFP plains is planted towards the end of January. Contact should be made with Mahfooz Ali Shah, Director General, Agriculture (Extension Services), Peshawar so that arrangements can be made to visit farmers in Pabbi area. His telephone number is 41080.

2.5 Training materials and extension bulletins

2.5.1 Training materials to accompany the lectures, demonstrations, and field visits will have to be prepared in Farsi and Pushto. When the ADT extensionists return to Afghanistan to work with farmers, they will need to take extension bulletins to share with colleagues, and handouts for farmers with simple instructions on production methods.

POTATO PRODUCTION IN AFGHANISTAN: THE PRESENT SITUATION AND STRATEGY FOR IMPROVEMENT

1. The Present Situation

1.1 Production trends

1.1.1 During the past three decades potato has become an established vegetable crop in Afghanistan, and official government statistics for the late-1970s showed that nearly 20,000 ha were under cultivation (Table 1).

Table 1. Potato production, 1975-78.

Season	Area ('000 ha)	Production ('000 t)	Yield (t/ha)
1975-76	17	194.5	11.4
1976-77	19.8	354.0	17.9
1977-78	19	200.0	0.5

1.1.2 The total production in 1976-77 appears abnormally high and cannot be explained. Annual production of about 200,000 t seems more realistic. FAO estimates of production of over 300,000 t in the mid-1980s are unreliable.

1.1.3 No data are available on current production which must have been drastically reduced since the civil strife began. In 1987, it was estimated that about 30% of farmland was out of production, and by now this could have been reduced to 20-25%.

1.1.4 Sample surveys of farmers from provinces throughout Afghanistan, published in the reports of the Agricultural Survey of Afghanistan by the Swedish Committee for Afghanistan, Peshawar, show that more than twice the number of farmers grew potatoes in 1989 than in 1988 (Table 2). However, this increase was not maintained in 1990. Unfortunately, no comparable pre-1980 data are available.

1.1.5 The average potato area grown by each farmer in Bamiyan, Logar, Wardak, and Ghazni was about 2 jeribs, and was only exceeded in Baghlan where the average was 4 jeribs. Farmers in many other provinces grew potatoes but the percentages were very low. Fluctuations in yields could be due to sampling error, but such factors as the availability of fertilizers cannot be discounted. It is obvious that yields could be improved dramatically.

Table 2. Percentage of farmers growing potatoes and estimated yield, 1988-90. (From survey reports, Swedish Committee for Afghanistan, Peshawar)

Province	1988		1989		1990	
	% farmers growing potato	Yield (t/ha)	% farmers growing potato	Yield (t/ha)	% farmers growing potato	Yield (t/ha)
Baghlan	2	18.2	12	18.4*	7	8.6
Samangan	1	22.3	3	10.5	11	6.8
Paktia	2	6.9	7	-	7	5.6
Bamiyan	30	10.6	62	24.2*	54	16.1*
Logar	15	18.8	25	23.5	19	14.7*
Wardak	32	15.7	78	10.7*	80	12.9*
Kapisa	8	15.3	13	7.0	1	4.7
Ghazni	13	5.2	32	10.4*	27	16.8*
Paktika	5	3.1	25	3.4	21	2.0
Herat	-	-	-	-	11	7.8

* Yield data from more than 10% of farmers (1989 & 1990 only)

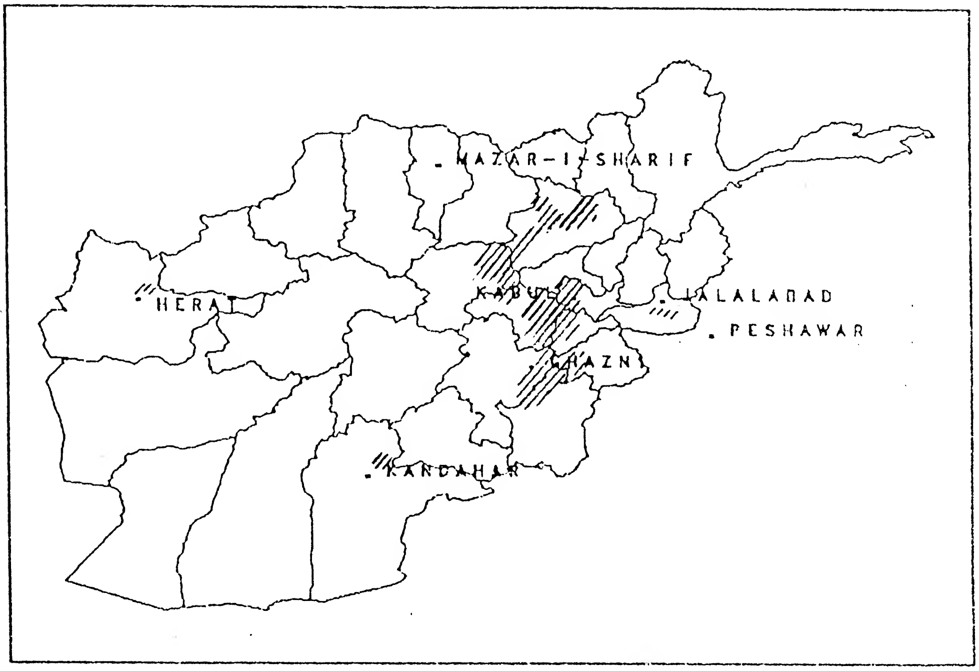
1.2 Production Areas

1.2.1 The crop is concentrated in the highland areas at elevations of 1800-2600 masl, with more than 80% of the total production coming from the provinces of Bamiyan, Baghlan, Wardak, Ghazni, Kapisa, Logar, and Kabul (Fig. 1). Other provinces with high elevation land also contribute a substantial quantity to the total production. In the late 1970s, Bamiyan was the most important growing area producing 50% of the crop. Very minor production occurs at lower elevations of less than 1000 masl in Kandahar, Konar, Laghman, and Herat.

1.3 Cropping Seasons

1.3.1 The highland crop, which is irrigated, is planted in April-May after the rainy season and harvested in September-October. At lower elevations the cropping season is from February to May-June.

Fig. 1. Potato production areas in Afghanistan.



1.4 Varieties and Seed Source

1.4.1 Two 'local' white-skinned varieties called Garma and Sarda dominate potato cultivation, the latter being more widely grown. It is not known if these are distinct varieties or if the latter appears different than Garma because it shows leaf crinkle that could be caused by virus infection. In the 1970s an Indian aid program tested a number of Indian varieties and subsequently imported small quantities (100-150 t) of seed tubers, mainly Kufri Chandramukhi and Kufri Lauvkar. These varieties were widely distributed but were not preferred by consumers, and there is no information on whether they were successful in replacing the local varieties in those areas where they were introduced.

1.4.2 Since there is neither importation of seed tubers nor a seed production scheme within the country, farmers either retain some of their harvest as seed tubers or purchase planting material from their neighbors or the local market.

1.5 Production/Productivity Constraints

1.5.1 After discussions with Afghan staff of DAI's Afghanistan Agricultural Sector Support Program and extensionists attending the ADT Summer Training Course, the following have been identified as the most important factors limiting potato growing and improvement in productivity levels:

- Insufficient labor
- Unavailability of seed tubers
- Poor quality seed tubers
- Lack of inputs, e.g., fertilizers
- Losses in storage
- Poor agronomic practices
- Diseases and pests
- Marketing problems

1.5.1.1 **Insufficient labor.** Potato cultivation is labor intensive, especially at planting, weeding and ridging, and harvesting. The crop needs continual attention during the first five to six week when weeding and ridging operations must be carried out, and for irrigation throughout the growing season--every 7-10 days in the plains and every 12-14 days in the highlands. Reduced animal traction power for seedbed preparation, due to loss of animals during the civil strife, will also exacerbate problems caused by a lack of manual labor. Insufficient labor is probably the most important factor responsible for the reduced cultivation of the crop.

1.5.1.2 **Nonavailability of seed tubers.** For farmers who are returning to growing potatoes, and who have not accumulated their own stock of seed tubers, the nonavailability of seed tubers in the market at planting time could also contribute to the reduced area of production. However, this should not be regarded as important in and around major potato-growing areas.

1.5.1.3 **Poor quality seed tubers.** Seed potato stocks of poor health status are probably the most important factor limiting the yielding potential of the crop. Since there is neither a seed production scheme within the country nor importations of good quality or certified seed tubers, the quality of the farmers' own planting material and that in the informal seed trade must be slowly deteriorating. Unfortunately there is no information on aphid population dynamics or degeneration rates of potato stocks in the highland areas, where it is possible that farmers still have stocks with acceptably low levels of leafroll and severe mosaic virus diseases. Twelve years ago it was possible to find crops of the local varieties in Bamiyan with low levels of virus infection, and this could still be the case today in that area and in other highland zones. Yields of over 20 t/ha reported in 1988 and 1989 tend to support this view. Providing that no soil-borne diseases and pests such as bacterial wilt and the golden nematode have become established in these areas during the past decade, farmers will be able to improve the quality of their seed stocks by using the seed plot technique. This is based on the principle of selecting a limited number of healthy-looking plants from within a crop, storing the tubers from these selections separately, and using them the following season to plant a seed plot. This approach to seed stock improvement is not feasible at lower elevations where populations of the aphid Myzus persicae are high and therefore virus spread is rapid, and where wilts caused by Fusarium spp. and Verticillium albo-atrum are known to be present.

1.5.1.4 **Lack of inputs.** Of all field crops, potato gives the best response to farmyard manure (FYM), and significant yield increases can be obtained with small amounts of artificial fertilizer. Where possible, farmers use FYM on their potato crop, but the reduction in numbers of farm animals as a result of the civil war will have greatly reduced the quantity of FYM. Few farmers have access to artificial fertilizer, and often they do not have sufficient money to purchase the quantities needed to optimize yields, even when it is available. Urea, the only fertilizer manufactured in the country, is generally available, but phosphatic fertilizers are in very short supply. Farmers are reported not to be applying any fertilizer. The yield response to phosphate can be considerable, especially in soils low in P. This element contributes to early development of the crop and early tuberization, and is also reported to increase the number of tubers per plant. Productivity levels will continue to remain low if the crop does not receive sufficient phosphate.

1.5.1.5 **Losses in storage.** In the highlands, tubers not sold at harvest are kept in the dark in buildings until November and then stored in pits in the ground during the winter. This is the only method available to farmers in areas with extremely low temperatures. Losses of 15-20 percent have been reported when pits are opened in March or April when the tubers are beginning to sprout, but DAI extensionists suggest that losses can reach 30% or more. This high level of loss could be reduced by more careful selection and handling of tubers when the pits are filled.

1.5.1.6 **Poor agronomic practices.** Experience has shown that there are a number of agronomic practices, not mentioned elsewhere in section 5, that can contribute, individually or combined, to low productivity levels. The more important of these are:

a) Seed tubers not at the correct physiological stage at the time of planting.

b) Tubers cut into seed pieces that are too small, even though containing 2-3 eyes.

c) The seed pieces planted immediately they are cut, without allowing the cut surface to suberize or not treating the seed pieces with fungicide. Rotting of the seed pieces results in poor emergence.

d) Competition from weeds and poor earthing up that does not provide plants with sufficient soil for optimal tuber formation.

e) Inadequate irrigation, especially during crop establishment and from tuber initiation throughout the bulking period.

1.5.1.7 **Diseases and pests.** DAI extensionists say that blight is the most serious disease. This is assumed to be late blight caused by Phytophthora infestans and not early blight due to infection with Alternaria solani. If late blight is causing economic losses in the summer crop in the highland areas, where environmental conditions--temperature and humidity--will favor the spread of the disease, farmers will have to spray with a fungicide such as Dithane M-45. Fungicides are currently not available. None of the European varieties grown in similar situations in nearby countries like Pakistan have a high enough level of field resistance to withstand the disease without spraying. Early blight, which needs warmer and drier weather than late blight to build up to epiphytotic levels, can occasionally be a problem in the plains and lower hill areas. Very rarely is it economic to spray against this disease. Of the other diseases that have been recorded in the country, only those caused by viruses are of widespread importance and cause economic losses nationwide. The others include stem rot and black scurf (*Rhizoctonia solani*), Verticillium wilt, Fusarium wilt, and pink rot (*Corynebacterium sepedonicum*). Potentially dangerous diseases known to occur in neighboring countries include powdery scab (*Spongospora subterranea*) and bacterial wilt (*Pseudomonas solanacearum*). Control or partial control of these diseases that are also soil-borne can be achieved by using clean seed and following a good rotation pattern where potatoes are not grown consecutively in the same field. However, the latter two organisms can infest soils for many years and are very difficult to control. The two most important insect pests are aphids and cutworms. Certain species of aphids are important vectors of virus diseases but do no direct damage to the crop. They cannot be controlled by spraying. Cutworms can be locally troublesome, but can easily be controlled by soil application of a proprietary insecticide.

1.5.1.8 **Marketing problems.** Even under normal conditions in peacetime, the marketing of perishable vegetable crops presents serious problems to farmers. The difficulties that farmers must be facing in Afghanistan today are therefore multiplied. Export to Pakistan and the long distance trucking of potatoes from the major growing areas to the large urban centers in the country must have been badly curtailed or even, in some cases, impossible. In many countries of the torrid zone, marketing is always listed by potato growers as their most important constraint to profitability. Afghanistan is no exception, but the internal troubles over recent years has undoubtedly affected those farmers, especially in provinces like Bamiyan, who grow potatoes as one of the main cash crops. Farmers in the lowland areas where the crop is harvested in May/June could profit from cold storage facilities, but the spring crop is very small, compared with the main summer crop, and cold storage might not be profitable. Commercialization will always remain a problem area.

2. Strategy for Potato Improvement

2.1 Introduction

2.1.1 Potato is extensively grown in many provinces although the greater percentage of production comes from only a few where the crop can be grown at higher elevations. Many farmers grow only very small areas, from less than one jerib to one or two jeribs. The fact that potato is regarded as the most important vegetable in many provinces, and is grown by large numbers of farmers, indicates that the crop merits attention. In times of war and food shortages, potato has shown itself to be an important component of a nation's vegetable basket. Although tubers contain between 75% and 80% water, there is 18-20% carbohydrate, about 2% protein, vitamins and minerals.

2.1.2 At this particular time, in areas where potatoes can be grown and where there is a need for more food, many more families should be encouraged to plant small plots of potato to feed the household. The tubers can be kept for many months, but in areas where temperatures are very high immediately after harvest storage can only be for a number of weeks.

2.1.3 Analysis of the problems faced by farmers indicate that seed tuber quality, storage, disease control, and crop agronomy need immediate attention. All these aspects can be relatively easily targeted through:

- Improving the quality of farmers' own seed tubers through on-farm selection (seed plot technique);
- Importing and testing one or two white-skinned varieties that should outyield crops of the local varieties grown from farmers' own seed or seed bought in the local market;
- Improving storage and field agronomy through training extension workers in these technologies; and
- Preparing extension bulletins and leaflets for farmers in Farsi and Pushto on different aspects relating to potato cultivation and on-farm seed production methods.

2.2 Improving seed tuber quality: the seed plot technique

2.2.1 Farmers in Afghanistan are not able to buy certified or improved seed potatoes because there is no seed scheme within the country and there is no importation of seed tubers.

2.2.2 Those farmers who grow potatoes at low elevations are unable to keep tubers from one planting season to the next and therefore must purchase seed tubers in the local market or from another province where the crop is grown at higher elevations and stored from one year to the next. In these highland areas some farmers will have poor crops with a high percentage of virus and other diseases that are transmitted in the tubers. With these types of crops it is very difficult, but not impossible, for farmers to improve the health status of their stocks. When crops contain a reasonable percentage of healthy-looking plants, it is very easy to improve the quality of the seed tubers that farmers save for their next year's crop.

2.2.3 The principle behind the method is one of positive selection, i.e., the selection of healthy-looking plants to provide tubers for the following seed crop. The method is known as the **seed plot technique.**

2.2.4 **Procedure.** The size of the farmer's selection program depends on the number of jeribs that he usually grows. The program includes the following steps:

(a) If the farmer has more than one field of potatoes, he decides on the best field in which to make his selections.

(b) Selection should be made when the plants almost touch each other and can still be recognized as individual plants. If the crop is a mixture of two or more varieties, selection should be made at flowering time when varietal differences are more easily recognizable. Mark the best healthy-looking and most vigorous plants in the field with stakes. Stake all plants needed at the same time. Stake only plants of the same variety to avoid mixtures. Stake more plants than are actually needed to plant the seed plot the following year.

(c) Check the staked plants during the remainder of the growing season and remove stakes from any that develop virus symptoms or look unhealthy (e.g. wilting). Plants with foliar diseases such as early or late blight should still be selected.

AFGHANISTAN AGRICULTURAL SECTOR SUPPORT PROJECT

PRIVATE SECTOR AGRIBUSINESS (ASSP/PSA)

POTATO PRODUCTION IN AFGHANISTAN: THE PRESENT SITUATION & STRATEGY FOR IMPROVEMENT

Prepared for

OFFICE OF THE AID REPRESENTATIVE
FOR AFGHANISTAN (O/AID/REP)

Prepared by

Garry Robertson

August 1991

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
Contract No: 306-0204-C-00-9829-00

TABLE OF CONTENTS

Page No.

1. The Present Situation.............................. 1

1.1 Production trends........................... 1

1.2 Production areas............................ 2

1.3 Cropping seasons............................ 2

1.4 Varieties and seed source................... 3

1.5 Production/productivity constraints......... 4

2. Strategy for Potato Improvement.................. 8

2.1 Introduction................................ 8

2.2 Improving seed tuber quality: the seed plot technique................................... 9

2.3 Selecting new varieties..................... 12

2.4 Extension training program.................. 14

2.5 Training materials and extension bulletins... 16